



**RE: TESTING OF (3) SAMPLES OF LUDLOW 300 MM (12") DIAMETER
SMOOTHWALL TYPE 'S' POLYETHYLENE PIPE TO AASHTO
M294M-04 FOR THE ESC PROGRAM**

CONDITIONING: Not less than 40 hours at $23 \pm 2^{\circ} \text{C}$ (73° F)

TEST RESULTS:

SECTION 6.1 BASIC MATERIALS

Results:

Sample	DENSITY (g/cm ³)	MELT INDEX (g/10 minutes)	CARBON
TRI Environmental	0.953	0.11	2.54
ADS	0.953	0.10	2.55

SPECIFICATION: Minimum Cell Class 335400C and SP-NCTL 15% 24hours
Density .948 to .955 g/cm³
Melt index .15 to .40 g/10 min.
Carbon Black Content 2% minimum / 5% Maximum
*Compounds that have a higher cell classification in one or
more properties with the exception of density are acceptable
provided product requirements are met.

CONCLUSIONS: Specification is met.

SECTION 7.1 WORKMANSHIP

SAMPLE	RESULTS
TRI Environmental	Pass
ADS	Pass

SPECIFICATION: Free of foreign inclusions and visible defects. Inner liner shall
be fused to outer corrugated wall at all internal corrugation crests.

CONCLUSIONS: Specification is met.

SECTION 7.2 PIPE DIMENSIONS

SECTION 7.2.2 WALL THICKNESS

SAMPLE	Inner Wall Thickness
TRI/Environmental	0.056"
Production	0.052"

SPECIFICATION : The minimum inner wall thickness requirement is 0.9 mm
0.035"

CONCLUSIONS: Specification is met.

SECTION 7.2.3 INSIDE DIAMETER

Sample	INSIDE DIAMETER
TRI/Environmental	12.10"
ADS	12.20"

SPECIFICATION: Nominal inside diameter shall not exceed 4.5% oversize or 1.5% undersize and not more than 30mm oversize. 296 mm / 314 mm (11.65" / 12.36")

CONCLUSIONS: Specification is met.

SECTION 7.4 PIPE STIFFNESS

Sample	Orientation	Pipe Stiffness
TRI/ Environmental	0 / 45 / 90	54 / 56 / 52
ADS	0 / 45 / 90	55 / 57 / 54

SPECIFICATION: Minimum pipe stiffness requirement at 5% deflection is
345kPa (50.0PSI)

CONCLUSIONS: Specification is met.

SECTION 7.5 PIPE FLATTENING

Sample	Results
TRI/Environmental	Pass
ADS	Pass

SPECIFICATIONS: No evidence of buckling, cracking, splitting or delamination. when the vertical inside diameter is reduced by 20%.

CONCLUSIONS: Specification is met.

Section 7.6 ENVIRONMENTAL STRESS CRACKING

Sample	Results
TRI/ Environmental	Pass
ADS	Pass

SPECIFICATIONS: There shall be no cracking of the pipe.

CONCLUSIONS: Specification is met.

SECTION 7.7 BRITTLENESS

Sample	Results
TRI/Environmental	Pass
ADS	Pass

SPECIFICATION: The pipe specimens shall not crack or split.
Five non-failures out of six impacts will be acceptable.

CONCLUSIONS: Specification is met.

SECTION 7.8 FITTING REQUIREMENTS

Sample	Results
TRI/Environmental	Pass
ADS	Pass

SPECIFICATIONS: Pipe connections shall not separate to create a gap exceeding 5mm. (0.197") when measured between the bell and spigot portions of pipe fittings shall not crack or delaminate.

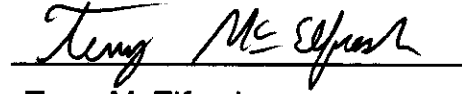
CONCLUSIONS: Specification is met.

SECTION 11 MARKING

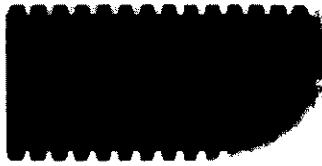
Sample	MFG	SIZE	PLANT CODE	PRODUCTION DATE
TRI/Environmental	ADS	12" 300mm	L (Ludlow)	N/A
ADS	ADS	12" 300mm	L (Ludlow)	02/18/05

SPECIFICATION: Pipe and fitting shall be marked at intervals not more than 3.5m, manufacture's name or trademark, nominal size, AASHTO M294, plant code and date of manufacture of appropriate code.

CONCLUSIONS: Specification is met.



Terry McElfresh
Quality Control Manager



THE MOST ADVANCED NAME IN DRAINAGE SYSTEMS



**RE: TESTING OF (3) SAMPLES OF LUDLOW 900 MM (36") DIAMETER
SMOOTHWALL TYPE 'S' POLYETHYLENE PIPE TO AASHTO
M294M-04 FOR THE ESC PROGRAM**

CONDITIONING: Not less than 40 hours at $23 \pm 2^{\circ} \text{C}$ (73°F)

TEST RESULTS:

SECTION 6.1 BASIC MATERIALS

Results:

Sample	DENSITY (g/cm ³)	MELT INDEX (g/10 minutes)	CARBON
TRI Environmental	0.951	0.35	2.30
ADS	0.953	0.33	2.10

SPECIFICATION: Minimum Cell Class 335400C and SP-NCTL 15% 24hours
Density .948 to .955 g/cm³
Melt index .15 to .40 g/10 min.
Carbon Black Content 2% minimum / 5% Maximum
*Compounds that have a higher cell classification in one or more properties with the exception of density are acceptable provided product requirements are met.

CONCLUSIONS: Specification is met.

SECTION 7.1 WORKMANSHIP

SAMPLE	RESULTS
TRI Environmental	Pass
ADS	Pass

SPECIFICATION: Free of foreign inclusions and visible defects. Inner liner shall be fused to outer corrugated wall at all internal corrugation crests.

CONCLUSIONS: Specification is met.

SECTION 7.2 PIPE DIMENSIONS

SECTION 7.2.2 WALL THICKNESS

SAMPLE	Inner Wall Thickness
TRI/Environmental	0.116"
Production	0.108"

SPECIFICATION : The minimum inner wall thickness requirement is 1.7mm
0.067"

CONCLUSIONS: Specification is met.

SECTION 7.2.3 INSIDE DIAMETER

Sample	INSIDE DIAMETER
TRI/Environmental	35.80"
ADS	35.70"

SPECIFICATION: Nominal inside diameter shall not exceed 4.5% oversize or 1.5% undersize and not more than 30mm oversize. 887 mm / 930 mm (34.92" / 36.61")

CONCLUSIONS: Specification is met.

SECTION 7.4 PIPE STIFFNESS

Sample	Orientation	Pipe Stiffness
TRI/ Environmental	0 / 45 / 90	30 / 29 / 28
ADS	0 / 45 / 90	29 / 28 / 27

SPECIFICATION: Minimum pipe stiffness requirement at 5% deflection is
150kPa (22PSI)

CONCLUSIONS: Specification is met.

SECTION 7.5 PIPE FLATTENING

Sample	Results
TRI/Environmental	Pass
ADS	Pass

SPECIFICATIONS: No evidence of buckling, cracking, splitting or delamination.
when the vertical inside diameter is reduced by 20%.

CONCLUSIONS: Specification is met.

Section 7.6 ENVIRONMENTAL STRESS CRACKING

Sample	Results
TRI/ Environmental	Pass
ADS	Pass

SPECIFICATIONS: There shall be no cracking of the pipe.

CONCLUSIONS: Specification is met.

SECTION 7.7 BRITTLENESS

Sample	Results
TRI/Environmental	Pass
ADS	Pass

SPECIFICATION: The pipe specimens shall not crack or split.
Five non-failures out of six impacts will be acceptable.

CONCLUSIONS: Specification is met.

SECTION 7.8 FITTING REQUIREMENTS

Sample	Results
TRI/Environmental	Pass
ADS	Pass

SPECIFICATIONS: Pipe connections shall not separate to create a gap
exceeding 5mm. (0.197") when measured between the bell and spigot portions of
pipe fittings shall not crack or delaminate.

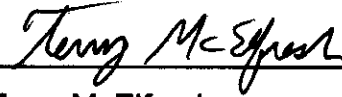
CONCLUSIONS: Specification is met.

SECTION 11 MARKING

Sample	MFG	SIZE	PLANT CODE	PRODUCTION DATE
TRI/Environmental	ADS	36" 900mm	L (Ludlow)	N/A
ADS	ADS	36" 900mm	L (Ludlow)	02/18/05

SPECIFICATION: Pipe and fitting shall be marked at intervals not more than 3.5m, manufacture's name or trademark, nominal size, AASHTO M294, plant code and date of manufacture of appropriate code.

CONCLUSIONS: Specification is met.



Terry McElfresh
Quality Control Manager